What is claimed is:

1. A method for selecting a swapping technique from a group consisting of a bit-swapping and a gain-swapping techniques in a discrete multi-tone (DMT) system having multiple sub-channels, gain factor constraints, a threshold index value (T), and a maximum mean square error (MSE_{max}) and a minimum mean square error (MSE_{min}), the method comprising:

determining a first index value (I) and a second index value (J) based on MSE_{max}, MSE_{min} and said gain factor constraints according to a predetermined manner, I denoting range of improvement when adopting the gain-swapping as the swapping technique, and J denoting range of improvement when adopting a combination of the gain-swapping and the bit-swapping as the swapping technique;

determine whether larger one of I and J is larger than T;

if the larger one of I and J is larger than T, determining whether I is equal to or larger than J; and selecting the gain-swapping as the swapping technique if I is equal to or larger than J.

2. The method as recited in claim 1, further comprising a step of

selecting a combination of gain-swapping and bit-swapping as the swapping technique if I is smaller than J.

3. The method as recited in claim 1, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the sub-channel respecting MSE_{min}, said predetermined manner comprises

the steps of:

obtaining a first gain margin value (Gmv1) by subtracting g_{max} from Gcm, and obtaining a second gain margin value (Gmv2) by subtracting Gcn from g_{min};

obtaining a first parameter (P1) by subtracting MSE_{min} from MSE_{max}; and

obtaining the I by doubling a smallest one of the group consisting of Gmv1, Gmv2 and (0.5*P1).

4. The method as recited in claim 1, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the sub-channel respecting MSE_{min}, MSE_{avgbs} denotes an arithmetic average of MSE_{max} and MSE_{min} after bit-swapping and MSE_{maxbs} denotes MSE_{max} after bit-swapping, and as MSE_{maxbs} is smaller than MSE_{avgbs} , the predetermined manner comprises the steps of:

obtaining a third gain margin value (Gmv3) by subtracting Gcn from g_{max}, and obtaining a fourth gain margin value (Gmv4) by subtracting g_{min} from Gcm;

obtaining a second parameter (P2) by subtracting MSE_{maxbs} from MSE_{minbs};

obtaining a third parameter (P3) by subtracting MSE_{maxbs} and a smallest one of the group, consisting of Gmv3, Gmv4 and (0.5*P2), from MSE_{avgbs}; and

obtaining the J by subtracting MSE_{min} and (2*P3) from MSE_{max}.

5. The method as recited in claim 1, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the

gain of the sub-channel respecting MSE_{min}, MSE_{avgbs} denoted the arithmetic average of MSE_{max} and MSE_{min} after bit-swapping and MSE_{maxbs} denotes MSE_{max} after bit-swapping and MSE_{minbs} denotes MSE_{min} after bit-swapping, and as MSE_{maxbs} is not smaller than MSE_{avgbs}, the predetermined manner comprises the steps of:

obtaining a fifth gain margin value (Gmv5) by subtracting g_{max} from Gcm, and obtaining a sixth gain margin value (Gmv6) by subtracting Gcn from g_{min};

obtaining a fourth parameter (P4) by subtracting MSE_{minbs} from MSE_{maxbs};

obtaining a fifth parameter (P5) by subtracting MSE_{avgbs} and a smallest one of the group, consisting of Gmv5, Gmv6 and (0.5*P4), from MSE_{maxbs}; and

obtaining the J by subtracting MSE_{min} and (2*P5) from MSE_{max}.

6. The method as recited in claim 1, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the sub-channel respecting MSE_{min}, MSE_{avgbs} denotes the arithmetic average of MSE_{max} and MSE_{min} after bit-swapping, MSE_{maxbs} denotes MSE_{max} after bit-swapping, MSE_{minbs} denotes MSE_{min} after bit-swapping, and as MSE_{maxbs} is smaller than MSE_{avgbs}, the predetermined manner comprises the steps of:

obtaining a seventh gain margin value (Gmv7) by subtracting Gcn from g_{max}, and obtaining a eighth gain margin value (Gmv8) by subtracting g_{min} from Gcm;

obtaining a sixth parameter (P6) by subtracting MSE_{maxbs} from MSE_{minbs};

obtaining a seventh parameter (P7) by subtracting a smallest one of the group, consisting of Gmv7, Gmv8 and (0.5*P6), and MSE_{avgbs} from MSE_{minbs}; and

obtaining the J by subtracting MSE_{min} and (2*P7) from MSE_{max}.

7. The method as recited in claim 1, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the channel respecting MSE_{min}, MSE_{avgbs} denotes the arithmetic average of MSE_{max} and MSE_{min} after bit-swapping, MSE_{maxbs} denotes MSE_{max} after bit-swapping, MSE_{minbs} denotes MSE_{min} after bit-swapping, and as MSE_{maxbs} is not smaller than MSE_{avgbs}, the predetermined manner comprises the steps of:

obtaining a ninth gain margin value (Gmv 9) by subtracting g_{max} from Gcm, and obtaining a tenth gain margin value (Gmv10) by subtracting Gcn from g_{min};

obtaining a eighth parameter (P8) by subtracting MSE_{minbs} from MSE_{maxbs};

obtaining a ninth parameter (P9) by subtracting MSE_{minbs} and a smallest one of the group, consisting of Gmv9, Gmv10 and (0.5*P8), from MSE_{avgbs}; and

obtaining the J by subtracting MSE_{min} and (2*P9) from MSE_{max}.

8. A method for performing gain-swapping in a discrete multi-tone (DMT) system having multiple sub-channels, gain factor constraints, and a maximum mean square error (MSE_{max}) and a minimum mean square error (MSE_{min}), wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the channel respecting MSE_{min}, said method comprising the steps of:

obtaining an eleventh gain margin value (Gmv11) by subtracting g_{max} from Gcm,

and obtaining a twelfth gain margin value (Gmv12) by subtracting Gcn from g_{min};

obtaining a tenth parameter (P10) by subtracting MSE_{min} from MSE_{max};

obtaining the value MIN of the smallest one of the group consisting of Gmv11, Gmv12 and (0.5*P10); and

adding gain in amount of MIN to the sub-channel having MSE_{max} and subtracting gain in amount of MIN from the sub-channel having MSE_{min}.

9. A swapping technique selector for selecting an optimal swapping technique from a group consisting of a bit-swapping and a gain-swapping techniques in a discrete multi-tone (DMT) system having multiple sub-channels, gain factor constraints, and a threshold index value (T) and a maximum mean square error (MSE_{max}) and a minimum mean square error (MSE_{min}), the swapping technique selector comprising:

a performance improvement pre-calculator for determining a first index value (I) and a second index value (J) based on MSE_{max}, MSE_{min} and said gain factor constraints according to a predetermined manner, I denoting range of improvement when adopting the gain-swapping as the optimal swapping technique, and J denoting range of improvement when adopting a combination of the gain-swapping and the bit-swapping as the optimal swapping technique;

a threshold comparator, connected to the performance improvement pre-calculator, for determining whether the larger one of I and J is larger than T;

a performance improvement comparator, connected to the threshold comparator, for selectively determining whether I is equal to or larger than J; and

a swapping technique selection device, connected to the performance

improvement comparator, for selecting either the gain-swapping or the combination of gain-swapping and bit-swapping as the optimal swapping technique.

10. The selector of claim 9, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the sub-channel respecting MSE_{min}, said predetermined manner comprises the steps of:

obtaining a first gain margin value (Gmv1) by subtracting g_{max} from Gcm, and obtaining a second gain margin value (Gmv2) by subtracting Gcn from g_{min};

obtaining a first parameter (P1) by subtracting MSE_{min} from MSE_{max}; and

obtaining the I by doubling a smallest one of the group consisting of Gmv1, Gmv2 and (0.5*P1).

11. The selector of claim 9, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the sub-channel respecting MSE_{min}, MSE_{avgbs} denotes an arithmetic average of MSE_{max} and MSE_{min} after bit-swapping and MSE_{maxbs} denotes MSE_{max} after bit-swapping, and as MSE_{maxbs} is smaller than MSE_{avgbs}, the predetermined manner comprises the steps of:

obtaining a third gain margin value (Gmv3) by subtracting Gcn from g_{max}, and obtaining a fourth gain margin value (Gmv4) by subtracting g_{min} from Gcm;

obtaining a second parameter (P2) by subtracting MSE_{maxbs} from MSE_{minbs};

obtaining a third parameter (P3) by subtracting MSE_{maxbs} and a smallest one of the

group, consisting of Gmv3, Gmv4 and (0.5*P2), from MSE_{avgbs}; and

obtaining the J by subtracting MSE_{min} and (2*P3) from MSE_{max}.

12. The selector of claim 9, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the sub-channel respecting MSE_{min}, MSE_{avgbs} denoted the arithmetic average of MSE_{max} and MSE_{min} after bit-swapping and MSE_{maxbs} denotes MSE_{max} after bit-swapping and MSE_{minbs} denotes MSE_{min} after bit-swapping, and as MSE_{maxbs} is not smaller than MSE_{avgbs}, the predetermined manner comprises the steps of:

obtaining a fifth gain margin value (Gmv5) by subtracting g_{max} from Gcm, and

obtaining a sixth gain margin value (Gmv6) by subtracting Gcn from g_{min};

obtaining a fourth parameter (P4) by subtracting MSE_{minbs} from MSE_{maxbs};

obtaining a fifth parameter (P5) by subtracting MSE_{avgbs} and a smallest one of the group, consisting of Gmv5, Gmv6 and (0.5*P4), from MSE_{maxbs}; and

obtaining the J by subtracting MSE_{min} and (2*P5) from MSE_{max}.

13. The selector of claim 9, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the sub-channel respecting MSE_{min}, MSE_{avgbs} denotes the arithmetic average of MSE_{max} and MSE_{min} after bit-swapping, MSE_{maxbs} denotes MSE_{max} after bit-swapping, MSE_{minbs} denotes MSE_{min} after bit-swapping, and as MSE_{maxbs} is smaller than MSE_{avgbs}, the predetermined manner comprises the steps of:

obtaining a seventh gain margin value (Gmv7) by subtracting Gcn from g_{max}, and obtaining a eighth gain margin value (Gmv8) by subtracting g_{min} from Gcm;

obtaining a sixth parameter (P6) by subtracting MSE_{maxbs} from MSE_{minbs};

obtaining a seventh parameter (P7) by subtracting a smallest one of the group consisting of Gmv7, Gmv8 and (0.5*P6) and MSE_{avgbs} from MSE_{minbs}; and

obtaining the J by subtracting MSE_{min} and (2*P7) from MSE_{max}.

14. The selector of claim 9, wherein the gain factor constraints have a maximum gain factor constraint (Gcm) and a minimum gain factor constraint (Gcn), g_{max} denotes the gain of the sub-channel respecting MSE_{max}, g_{min} denotes the gain of the channel respecting MSE_{min}, MSE_{avgbs} denotes the arithmetic average of MSE_{max} and MSE_{min} after bit-swapping, MSE_{maxbs} denotes MSE_{max} after bit-swapping, MSE_{minbs} denotes MSE_{min} after bit-swapping, and as MSE_{maxbs} is not smaller than MSE_{avgbs}, the predetermined manner comprises the steps of:

obtaining a ninth gain margin value (Gmv 9) by subtracting g_{max} from Gcm, and obtaining a tenth gain margin value (Gmv10) by subtracting Gcn from g_{min};

obtaining a eighth parameter (P8) by subtracting MSE_{minbs} from MSE_{maxbs};

obtaining a ninth parameter (P9) by subtracting MSE_{minbs} and a smallest one of the group consisting of Gmv9, Gmv10 and (0.5*P8) from MSE_{avgbs}; and

obtaining the J by subtracting MSE_{min} and (2*P9) from MSE_{max}.